ATTACHMENT "A"

PROJECT TITLE: Wet and Dry Weather Storm Drain Discharge Characterization Studies

SUBMITTED TO: Ben Higgins, Project Director
Engineering Services
Public Works
901 N. 6th St.
Lincoln, Nebraska 68508

APPLICANT INSTITUTION: The University of Nebraska-Lincoln
312 N 14th St, ALEX West
P.O. Box 880430
Lincoln, NE 68588-0430

PROJECT PERIOD: September 1, 2005 through August 31, 2006

AMOUNT REQUESTED $72,600

PRINCIPAL INVESTIGATOR: Bruce Dvorak, Associate Professor
Civil Engineering Department
W348 Nebraska Hall
University of Nebraska
Lincoln, Nebraska 68588-0531

SIGNATURES:

Date 6-24-05
Bruce Dvorak, Ph.D.
Principal Investigator

Date 6-27-05
John Stansbury, Ph.D.
Principal Investigator

Date 6-27-05
David Admiraal
Principal Investigator

Date 6/27/05
Mohamed Dahab, Ph.D., Co-Chair
Civil Engineering

Date 6/29/05
Norm Braaten
Director, Pre-Award Development
Research Grants and Contracts Office

PROPOSAL ACCEPTANCE:

Date _____
Mayor Coleen Seng

City of Lincoln

A Proposal for:
Wet and Dry Weather Storm Drain Discharge Characterization Studies

Overview

The proposed work concerns both wet weather and dry weather storm drain discharge characterization. The proposal is separated into two sections, wet weather and dry weather monitoring.

The wet weather monitoring concerns the collection and testing of representative/composite and grab samples of the municipal storm drain system of the City of Lincoln following storm events all as defined by federal regulations. Samples shall be collected using city supplied equipment at points approved by the Nebraska Department of Environmental Quality (NDEQ). There shall be three sample collection points.

The monitoring of dry weather flows from storm drains is to provide a field screening analysis for illicit connections and illegal dumping for either selected field screening points and major storm drain outfalls. Approximately 20% of the storm drain field sampling stations will be monitored during this period covered by this project.

I. Wet Weather Monitoring

The primary purpose of the wet weather monitoring component is to satisfy the requirements for monitoring under the NPDES stormwater permit. A second purpose is to analyze the data from the monitoring to identify trends in the wet weather water quality data.

Sampling Plan

Sampling Frequency and Locations

Wet weather monitoring will be performed at least three times per year at the three locations listed in Table 1. Monitoring shall be conducted in each of the following time-periods:

Early Spring Flush:	February thru April;
Late Spring & Summer:	May thru July; and
Fall:	September thru October.

To comply with the minimum monitoring requirements, at least 30 days shall be allowed between each monitoring event on any given outfall. Samples shall be taken at a minimum of 72 hours from a previous measurable event (greater than 0.1 inches). Samples shall be collected from precipitation events with rainfall amounts between 3/8 and 1 inch.

Table 1. Wet Weather Monitoring Locations

Monitoring Point Designation	WW-1	WW-2	WW-3
Name Designation	**Tipperary**	**N Street Storm Drain**	**Commerce Way**
Location Description	400 ft west of 27th St. & Tipperary Trail	1st & N Sts.	400 ft west of NW 15th & W. Commerce Sts.
Latitude	40° 45' 56.4"	40° 48' 13.9"	40° 50' 52.1"
Longitude	96° 41' 2.27"	96° 43' 13.9"	96° 44' 30.6"
Receiving Stream	Beal Slough	Salt Creek	Oak Creek
Predominant Land-Use Type	Residential	Commercial	Industrial

Sample Collection

Samples and measurements taken as required within this permit shall be representative of the discharge. All samples shall be taken at the monitoring points specified in this permit and, unless otherwise specified, before the effluent joins or is diluted by any other waste stream, body of water or substance.

a. Composite sampling shall be conducted in one of the following manners:
   (1) less than 24 hours - a minimum of hourly discrete aliquots or a continuously drawn sample shall be collected during the discharge, or
   (2) batch discharge - a minimum of three discrete aliquots shall be collected during each discharge.

b. Composite samples shall be collected in one of the following manners:
   (1) the volume of each aliquot must be proportional to either the waste stream flow at the time of sampling or the total waste stream flow since collection of the previous aliquot,
   (2) a number of equal volume aliquots taken at varying time intervals in proportion to flow, and
   (3) a sample continuously collected in proportion to flow.

c. Grab samples shall consist of a single aliquot collected over a time period not exceeding 15 minutes.

Sampling Equipment

Composite sampling equipment and flow measurement equipment will be supplied and installed at the sites by the City. The University of Nebraska shall be responsible for maintaining the monitoring equipment and associated appurtenances at the three urban runoff sampling locations. The University shall also be responsible for maintaining the all samplers, lines, bottles and batteries. Flow measurement devices and methods consistent with accepted scientific practices shall be used.

Samples will be collected using dedicated sample bottles. Bacterial samples will be collected in dedicated bottles supplied by the lab. Sampling personnel will be equipped with proper rain gear, boots, and rubber gloves. Sample bags will be stored in ice chests until they can be transferred to refrigerators in the UNL lab.

Sample Handling

Sample containers will be placed in coolers loaded with ice and transported immediately to the UNL lab where they will be stored in refrigerators until analyses are conducted. Sample containers will be labeled according to sample location and time of sampling. For example a sample taken at BMP site 2, at location b, on October 13 at 4:35 in the afternoon will be labeled 2b-10/13/03-1635.

Standard Chain of Custody forms will be maintained for each sample collected. The Chain of Custody forms will include date, time, location, sample location number, sample identification number, analyses to be conducted, name and signature of sampler

Records and Field Notes

Field notes will be kept by the sampling team. Field notes will describe: time and date of storm, time interval from last storm, air temperature, wind, description of the stormwater (e.g., floating debris, oil sheen), and anything that is observed that could affect sample results. A copy of the "NPDES Form PE – Record of Physical Examination Observations Results" or similar type format, is required to be filled out for each outfall tested. Records of all sampling or monitoring information shall include:

a. the date(s), exact place, time and methods of sampling or measurements,
b. the name(s) of the individual(s) who performed the sampling or measurements,
c. the date(s) the analyses were performed,
d. the individual(s) who performed the analyses,
e. the analytical techniques or methods used,
f. the results of such analyses, and
g. laboratory data, bench sheets and other required information.

Storm Tracking and Personnel

A team leader (or designee) will be on-call at all times and will be responsible for predicting target storms based on local weather reports. A team of ten samplers and sample handlers will be maintained. Samplers will work in teams of two samplers per team. Six (three teams) members of the team will be on call and available for any anticipated storm event which will be sampled. When a target storm begins the team leader or designee will make sure that six samplers are at the sampling sites.

Prior approval will be obtained from the City for any changes to the sampling plan.

Analytical Plan

Storm water shall be sampled in accordance with the requirements in 40 CFR 122, unless otherwise approved. Storm event information shall be recorded including storm duration, precipitation amount, number of days since previous storm event, and for snow melt events include the number of days since previous significant melting event. The following parameters

shall be monitored:

a. **Grab Samples** shall be collected during the initial flush of the discharge. Samples shall be analyzed for the following parameters:

   i) pH,
   ii) temperature,
   iii) total cyanide,
   iv) total phenols,
   v) residual chlorine,
   vi) oil and grease,
   vii) E. Coli,
   viii) fecal streptococcus, and
   ix) physical characteristics examination

b. **Composite Samples shall be analyzed for the following parameters:**

   i) total suspended solids (TSS),
   ii) total Kjeldahl nitrogen (TKN),
   iii) total dissolved solids (TDS),
   iv) nitrate plus nitrite nitrogen,
   v) chemical oxygen demand (COD),
   vi) dissolved phosphorus,
   vii) biochemical oxygen demand - 5 day (BOD_5),
   viii) total phosphorus, and
   ix) oil and grease.

Prior to analysis, samples will be stored at 4°C. Other preservatives used are noted in the description of the analytical method for that parameter. The following analytical methods will be used for each analysis. The UNL Civil Engineering laboratory facilities will be used unless otherwise specified.

Temperature

The temperature of the grab samples will be measured in the field using an alcohol thermometer with 1°C temperature increments following Method 2550 from Standard Methods for the Examination of Water and Wastewater (Standard Methods). The thermometer will be allowed to equilibrate and will be recorded to the nearest degree on the Chain of Custody sheet.

pH

The solution pH will be measured in the field using pocket pH meters by Hach and tested in the lab within 6 hours of sample collection. The pH meters are capable of measuring to the nearest 0.1 pH units, with a precision of about 0.2 pH units.

Total Cyanide,

Total Cyanide will be analyzed using the Pyrdine-Pyralone method of Hach, which is consistent with Standard Method 4500-CN^- E. The maximum holding time is 24 hours.

Total Phenols

Total phenols will be analyzed following Hach method 8047. The maximum holding time is 28 days.

Residual Chlorine
Will be tested using Hach Method 8167 (which is the consistent with Std. Method 4500). This will be tested on-site.

Oil and Grease
Samples for oil and grease will be analyzed by an external laboratory using EPA Method 1664. The maximum holding time allowed for oil and grease samples is 4 days.

E. coli
E. coli samples will be analyzed by the State of Nebraska Health and Human Services Laboratory. Samples will be collected into sterile bottles, and dropped off for analysis within one hour of the rain event. Enumeration by the State Lab will be done using the coli-lert-QT (quanti-tray method). The maximum holding time allowed for the E. coli samples is 8 hours.

Fecal Streptococcus
Fecal streptococcus will be analyzed by the State of Nebraska Health and Human Services Laboratory. Samples will be collected into sterile bottles, and dropped off for analysis within one hour of the rain event. The maximum holding time allowed for the fecal streptococcus samples is 8 hours.

Total Suspended Solids and Total Dissolved Solids
Will be measured following Standard Method 2540. The maximum holding time allowed for solids samples is 7 days.

Total Kjeldahl Nitrogen
Total kjeldahl nitrogen (TKN) will be analyzed by the UNL Water Science laboratory using EPA Method 351.3. This method can be used to measure TKN concentrations between 0 - 150 mg/L. The maximum holding time allowed for TKN is 24 hours.

Nitrate plus Nitrite Nitrogen
Nitrate plus Nitrite Nitrogen will be analyzed by the UNL Water Science laboratory using the Cd-reduction method (Standard Method 4500-N). The maximum holding time allowed is 24 hours.

Chemical Oxygen Demand (COD)
COD will be analyzed using the dichromate methods (Standard Method 5220) and has a maximum holding time of 7 days, after nearly immediate sample acidification.

Biochemical Oxygen Demand - 5 day (BOD_5)
BOD will be analyzed using Standard Method 5210 and the analysis will start within 24 hours of sample collection.

Total and Dissolved Phosphorous
Total and Dissolved Phosphorous will be analyzed according to Standard Method 4500-P. For dissolved phosphorous, samples will be filtered in the UNL Civil Engineering laboratory.

Samples for both total and dissolved phosphorous may be sent to the UNL Water Science laboratory for analysis. The maximum holding time is 24 hours.

Averages shall be calculated as an arithmetic mean except bacterial counts which shall be calculated as a geometric mean. All monitoring records (calibration and maintenance records, monitoring records and information, and all reports) will be organized and placed in a location agreeable to the City of Lincoln in case they need to be reviewed in the future. The records will be retained for at least three years.

Quality Assurance, Quality Control

UNL Civil Engineering (CIVE) will test 25 percent of the samples in duplicate (over the course of the year) to estimate the "relative percentage error" for each analysis performed by UNL CIVE. At least 6 blank samples will be tested for each analysis performed by UNL CIVE. The Method Detection Limit [MDL] (following Standard Methods for Water and Wastewater Analysis) will be determined at the start of the sampling season for each analysis performed by UNL CIVE. At least 6 standard samples with known concentrations will be tested for each analysis performed by UNL CIVE. Revised MDLs will be determined using this data. Three travel blanks will be taken to the field testing sites during one storm during the year and tested for all parameters. Six laboratory blanks will be analyzed for each parameter during the year.

Reports

The University shall provide the City with all data taken as a result of the monitoring results. The final report shall include written confirmation that the Quality Assurance and Quality Control Plan was performed. The final report submitted to the City will include:

a. Rainfall event, flow, and pollutant concentration summary information;
b. All monitoring results;
c. Calculated estimates of the pollutant masses discharged on both an event and an annual basis;
d. The Event Mean Concentrations (EMC's) from the Municipal Separate Storm Sewer Area;
e. A narrative description of any storm water quality improvement or degradation that may have been discovered; and a
f. data analysis from the wet weather storm events.

II. Dry Weather Monitoring

This work concerns monitoring of dry weather flows. The monitoring of dry weather flows from storm drains is to provide a field screening analysis for illicit connections and illegal dumping for either selected field screening points and major storm drain outfalls. Approximately 20% of the storm drain field sampling stations will be monitored during this period covered by this project. Innovative methods of sampling for episodic dry weather discharges of surfactants, phenolics and other chemicals will be investigated.

This project will consist of three phases as discussed below.

Phase I. Visit Field Sampling Sites, Collect Samples and Record Observations.

1. UNL Civil Engineering will have a team of at least two students visit each of approximately 55 field sampling sites during the summer of 2006. Each site will be visited at least three days after a measurable rainfall. The field sites to be visited are listed in the "Dry-Weather Stormwater Monitoring for Summer 2005". No more than 5 additional sites will be added to the summer of 2006 monitoring reflecting new outfall sites in newly developed portions of Lincoln and site to be resampled from the past two years.
2. UNL Civil Engineering will provide new information found concerning the storm drain outfalls during sample collection to the City.
3. UNL Civil Engineering will report the following concerning each site:
   - time, day, and weather during site visit, and
   - a narrative description of site appearance (e.g., if it appears that dry weather flows may have occurred).
4. If there is flowing water at a field site, UNL Civil Engineering will
   - collect two grab samples of water during a 24 hour period, with a minimum of 4 hours between samples,
   - prepare a narrative description of the water for the color, odor, turbidity, presence of an oil sheen or surface scum as well as any other relevant observations regarding the potential presence of non-storm water discharges or illegal dumping, and
   - a description of the flow rate.
   - if hazardous materials are discovered the Lincoln Fire Department Hazardous Spills Response Unit should be notified immediately. Illicit discharges or illegal dumping need to be reported immediately to the City of Lincoln and Lancaster County Health Department (LLCHD).
5. Innovative methods of sampling for episodic dry weather discharges of surfactants, phenolics and other chemicals will be investigated by developing and testing a new methodology on a limited number of dry weather monitoring sites.

Phase II. Analyze Samples and Perform Quality Control Analyses.

6. The analyses listed in Table 2 will be performed by University of Nebraska-Lincoln on water samples collected from each field site with flowing water. The total copper analysis will be performed by the UNL Water Sciences Laboratory.

Table 2. Summary of Laboratory Analyses

Procedure	Method	Anticipated Minimum Detection Limit	Max. Sample Hold Time
Temperature	thermometer	NA	On-site testing
Flow Measurement		NA	On-site testing
pH	Probe	NA	4 hours
Chlorine	Hach 8167 (Std. Methods 4500)	0.07 mg/L	On-site testing
Chloride	Hach 8113	0.9 mg/L	7 days
Total Phenol	Hach 8047	0.02 mg/L	28 days
Total Copper	Std. Methods 3030 with Atomic Absorption	30 µg/L	3 months
Detergents / Surfactants	Hach 8028	0.02 mg/L	24 hours
Fluoride	Hach 8029 (US EPA 340.1)	0.5 mg/L	7 days
Nitrate	Hach	0.9 mg/L	7 days
Sulfate	Hach 8051 (US EPA 375.4)	3. mg/L	7 days

7. UNL Civil Engineering (CIVE) will test half the samples in duplicate (over the course of the summer) to estimate the "relative percentage error" for each analysis performed by UNL CIVE.
8. UNL Civil Engineering will test at least 7 blank samples (over the course of the summer) for each analysis performed by UNL CIVE.
9. UNL Civil Engineering will determine the Minimum Detection Limit [MDL] (following Standard Methods for Water and Wastewater Analysis) at the start of the summer for each analysis performed by UNL CIVE.
10. UNL Civil Engineering will test at least 8 standard samples with known concentrations (over the course of the summer) for each analysis performed by UNL CIVE. A new MDL will be determined using this data.
11. Samples from any experimental methods for sampling for episodic dry weather discharges will be tested using the appropriate method from *Standard Methods for the Analysis of Water and Wastewater Samples*.

Phase III. Prepare Final Report.

12. UNL Civil Engineering will prepare a final report summarizing the field notes and water sample analysis data collected in the first three Phases. The final report will include several pages of discussion of the data and engineering suggestions. The final report will include tables that make it easy to compare the 2006 results to those found in previous studies. Computer disks will be attached to the final report containing excel spreadsheets of data.

Budget Details:

All equipment and supplies purchased for this project remain the property of UNL at the end of this project. This contract will be paid as a lump sum. This contract will be initiated as soon as possible after 1) appropriate approval by both UNL and the City of Lincoln, and 2) a qualified UNL student is recruited to carry out the work as specified above. The work will be carried out during the period between the approval date and August 31, 2006.

Budget

Personnel	
Principal Investigators	
B. Dvorak	$5,703
D. Admiraal	$3,500
J. Stansbury	$1,000
Subtotal:	$10,203
Fringe Subtotal x 0.26	$2,653
Graduate Research Assistant (GRA) (lead – 12 mo.)	$15,600
Graduate Research Assistant (sampling assistance-3.5 mo.)	$4,535
Subtotal	$20,135
GRA Health Insurance	$700
Graduate Fringe = GRA salary x .28	$5,638
Undergraduate hourly worker (Dry Weather Mon. – 350 hours, Wet Weather sample collection – 270 hours)	$5,890
Personnel & Benefits Total	$45,219
Lab Testing Fees	$10,746
Materials & Supplies, Equipment Maintenance	$7,435
Travel	$500
Operating (phone, copying, postage)	$350
Equipment: Laptop	$1,750
TOTAL DIRECT COSTS	$66,000
Indirect Costs Rate x .10	$6,600
TOTAL PROJECT COSTS (A-F)	$72,600